

ARGUS EXPLORATION COMPANY

555 South Flower Street

Suite 3670

Los Angeles, California 90071

Telephone (213) 628-0891

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E7.3 10985  
CR-133764

10 September 1973

National Aeronautics and Space Administration  
Goddard Space Flight Center  
Greenbelt, Maryland 20771

Attn: NASA Scientific & Technical Information Facility  
ERTS Contracting Officer, Code 245, GSFC  
ERTS Technical Officer, Code 430, GSFC  
ERTS Project Scientist, Code 650, GSFC  
ERTS Scientific Monitor, Code 650, GSFC  
J. H. Boeckel, Code 430, GSFC (2 cc.)

Subject: Type I Progress Report, 1 July through 31 August 1973  
Proposal - A Reconnaissance Space Sensing Investigation of  
Crustal Structure for a Strip from the Eastern Sierra Nevada  
to the Colorado Plateau

Reference: Proposal Control No. SR103  
GSFC Principal Investigator ID PRO 15  
ERTS-1 Contract NAS5-21809

Gentlemen:

In accordance with Article II, Item 3, and Paragraph 3.1 of the referenced contract,  
we hereby report the status of our ERTS-1 investigation.

I. Contract Objectives:

- A. Analysis, interpretation and evaluation of ERTS-1 data for application to  
study of regional crustal structure.
- B. Comparison and evaluation of selected available remote sensing techniques,  
including Apollo-9, X-15 and U-2 photography.
- C. Field investigation to confirm interpretation studies and evaluate  
significance and practical applications of geologic phenomena visible in  
ERTS imagery.

E73-10985) A RECONNAISSANCE SPACE  
SENSING INVESTIGATION OF CRUSTAL STRUCTURE  
FOR A STRIP FROM THE EASTERN SIERRA  
NEVADA TO (Argus Exploration Co., Los  
Angeles, Calif.) 8 p HC \$3.00 CSCL 08G

N73-31292

Unclas  
G3/13 00985

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## II. Scientific Staff and Back-up Personnel:

The following personnel are presently assigned to the ERTS-1 investigation:

### Scientific Staff

M. A. Liggett, Field Geologist and Co-investigator  
J. F. Childs, Field Geologist  
H. E. Ehrenspeck, Geologist

### Technical Aids

R. L. Hutchens, Technician and Field Assistant  
J. W. Barth, Technician and Field Assistant  
P. L. McClay, Photographic Technician (part time)

### Backup Personnel (covered in G & A)

Accountant  
Secretary

## III. Summary of Work Performed:

### A. Data Handling:

ERTS-1 and important subsidiary remote sensing data have been indexed and filed for efficient recall. Indexing and plotting of additional U-2, SLAR, X-15 and NIMBUS imagery is continuing.

### B. Literature Research:

Scientific literature and other research data in the Argus Exploration Company library are indexed in a multiple reference system. New journal subscriptions are adding significantly to our literature bank. Data sources include the Earth Resources Research Data Facility, NASA-JSC; WESRAC, University of Southern California; EROS Data Center, Sioux Falls, South Dakota; Pomona College, Claremont, California; University of California, Los Angeles; U. S. Geological Survey, Menlo Park, California.

### C. Scientific Communications and Correspondence:

Mr. W. E. Hosken, President, Argus Exploration Company, and M. A. Liggett, Co-investigator of the ERTS-1 Research Program have maintained close liaison with NASA project monitors Paul D. Lowman and Edward W. Crump on all phases of administration and technical progress. A meeting

between Mr. Liggett and NASA monitors Lowman and Crump was held at Goddard Space Flight Center on 20 July 1973, for a comprehensive technical review of research status. This meeting included discussion of the Argus Type II Progress Report for the period January thru June 1973.

Additional scientific correspondence has been conducted with other investigators involved in the ERTS-1 or other related remote sensing programs. We have worked with the following scientists in significant exchange of data, research techniques, or interpretation of results:

Dr. K. Ebtehadj, Dr. M. Akhavi and Mr. A. Ghazi, Plan and Budget Organization, Imperial Government of Iran, Tehran, Iran

Dr. Rushdi Said, Director, Geological Survey of Egypt, Cairo, Egypt

Dr. A. Volborth, Dalhousie University, Halifax, Nova Scotia

Dr. O. T. Tobisch, University of California, Santa Cruz, California

Dr. Richard Fiske, U.S. Geological Survey, Washington, D. C.

Mr. D. T. Vaniman, Geological Survey of Nigeria, Kaduna, presently at University of California, Santa Cruz, California

#### D. Image Analysis & Enhancement Procedures:

Experimentation with ERTS-1 MSS imagery analysis and enhancement techniques has continued in coordination with field reconnaissance and mapping. Several techniques which we have used are discussed in the Argus Exploration Company Type II report of July 1973. Our standard procedures incorporate the use of a four-channel additive color viewer for analysis of ERTS-1 MSS and other multispectral imagery.

Additional experimentation has been conducted on photographic edge-enhancement processing of ERTS-1 MSS data. This technique produces high resolution imagery in which linear image elements are enhanced over background tonal (gray level) content. This enhanced imagery has proved valuable in the study of structural patterns commonly obscured in unprocessed data.

The most important enhancement tool has continued to be high resolution false color compositing. A Report of Investigation is in preparation which outlines the procedures we have developed for making color composites from the standard NASA/NDPF data products.

## E. Geologic Reconnaissance & Mapping:

The following paragraphs summarize field research topics currently near completion.

### Sierra Nevada Range, California

Field work has been conducted in the southern Sierra Nevada on several sets of lineaments recognized in ERTS-1 MSS imagery between the Kern River and Owens Valley, California. The cause of these features is complex and somewhat enigmatic. Mafic and leucocratic dikes, regional joint sets, cataclastic foliation and small metamorphic roof pendants (in granitic rocks) have been mapped along portions of these lineaments which are geomorphologically represented as straight valleys or alignment of valleys. More work is planned in an attempt to understand their genetic cause (or causes), and to compare their character and distribution with that of regional structures in the surrounding parts of California and Nevada.

Limited reconnaissance has continued along several similar north-trending lineaments in the northeastern Sierra Nevada Mountains, also recognized in ERTS-1 MSS imagery. New portions of the lineaments have been examined and attention has been given to their geomorphic and geologic expression.

### Fish Lake Valley, Nevada

ERTS-1 structural anomalies have been investigated in a rhyolitic to basaltic volcanic terrane at the northern end of Fish Lake Valley, Nevada. This field work has established that the Death Valley-Furnace Creek Fault Zone cuts the southern part of the volcanic pile along the east side of the White Mountains but does not continue northward as a distinct fault zone. Rather, the fault pattern changes northward to a complex series of normal and strike-slip faults within the volcanics and this pattern is in turn terminated against an east-northeast trending fault zone of possible left lateral displacement. No evidence was found to indicate that the Death Valley-Furnace Creek Fault Zone extends north of this east-northeast zone.

Known mercury mineralization is associated with the faults in the volcanics near the termination of the Death Valley-Furnace Creek Fault Zone.

### Tonopah, Nevada to South of Goldfield, Nevada

Field reconnaissance of linear anomalies in ERTS-1 MSS imagery has revealed several large normal fault zones trending roughly north and south in the area west of Tonopah and Goldfield, Nevada. The most prominent of these features extends southward for approximately 35 miles between Paymaster Canyon and Lida Wash. The Paymaster Canyon-Lida Wash Fault is a west dipping normal fault which terminates abruptly on the south against a complex east-west structural zone in the Palmetto Mountains. Large normal faults east of the Paymaster Canyon-Lida Wash Fault also appear to terminate southward against the east-west zone. Field work southwest of Goldfield, Nevada has shown that many of these normal faults displace rocks of Paleozoic Age as well as the overlying Tertiary volcanic cover. This relationship has not been shown on previous geologic maps of the area. The north-south and the east-west trending faults studied in this region are the two most conspicuous structural trends visible in ERTS-1 imagery in the area immediately east of the Death Valley-Furnace Creek Fault.

### Delamar Mountains Area, Southeastern Nevada

Field work, guided by ERTS-1 data, was conducted in the region between the South Pahroc Range and the Delamar Mountains, Lincoln Co., Nevada. The work was undertaken in an attempt to understand how extensional Basin-Range faulting relates to a local zone of north-east-trending strike-slip faults, recognized by other workers.

In ERTS-1 imagery, the west face of the Delamar Mountains north of Gregerson Basin appears as a linear range front forming the eastern boundary of Delamar Valley. Field work in this area has confirmed that at least one previously unmapped high-angle fault zone occurs at, and parallel to the edge of the range.

Field work in the area around and south of Delamar Lake supports the interpretation of left-lateral strike-slip movement along several northeast trending fault zones. This strike-slip deformation does not continue northeastward into the Delamar Mountains beyond Gregerson Basin and is believed to be contemporaneous with late Tertiary range-front faulting.

#### IV. Conformance to Work Schedule and Recommended Changes in Operation:

Most phases of the Argus Exploration Company ERTS-1 research program are currently on schedule in accordance with the Network Schedule of April 1973 and Data Analysis Plan of 4 December 1972.

The Argus ERTS-1 research project is currently fully staffed for the first period in several reporting intervals. The increased staff has permitted concentration on several critical tasks of the program under constraint by seasonal or weather conditions.

Certain minor research tasks are being delayed for administrative reasons but no major delays in research are anticipated. No changes in operation are recommended over the Data Analysis Plan of December 1972 or the Network Schedule of April 1973.

V. Funding Status:

As indicated in Financial Reports 533 Q and 533 M dated 16 July 1973 and in report 533 M dated 15 August 1973, proposed project funding will be sufficient to complete the contracted research program.

VI. Analysis of Research Progress:

Research during this reporting period has concentrated on extensive field reconnaissance and mapping to make best advantage of the excellent field conditions in high terrane, inaccessible during much of the winter. Reports on significant results of this research are presently in preparation.

Experimental enhancement of ERTS-1 MSS data has continued with successful applications in support of data analysis and field investigations. High resolution color composites have been prepared for ten ERTS-1 MSS frames over critical portions of the Test Area. Map compilations of radiometric age dates and known mineral deposits within our test site have been brought up to date.

Administrative reorganization of the Argus ERTS-1 research program has facilitated efficient use of scientific staff and planning for laboratory and field research. All research progress anticipated for this reporting interval has been achieved. Although we have cited some delays in research during past reporting periods, it is anticipated that these delays will be corrected by accelerated progress in the next months.

VII. Significant Results:

No significant results are cited for this reporting interval. Reports of several completed research tasks are in preparation.

## VIII. Work Planned for the Next Reporting Period:

### A. Geologic Field Work:

Part of the next reporting period will be spent finishing several reports for which research is nearly complete. Several study areas will be flown with fixed wing aircraft in order to check regional structural interrelationships and to confirm ground-based observations especially in inaccessible areas. Hand held 35mm color and color infrared photographs will be taken during these flights.

A linear anomaly in the New York Mountains of California which is visible in oblique Apollo-9 Ektachrome photography will be studied in available ERTS-1 coverage. Field work will be conducted as required to determine if the anomaly in the Apollo photography was a result of the oblique look angle. If the anomalous feature appears to have geologic causes, an attempt will be made to explain the subtlety of expression in ERTS-1 imagery.

Several large northwest trending faults in the western Mojave Desert have been described by other workers as strike slip faults. We will investigate these features using ERTS-1 imagery in order to determine the nature of their expression, and possible new strands or extensions. Attention will be paid to possible tectonic relationships with the San Andreas and Garlock Fault Zones.

### B. Image Analysis and Enhancement Procedures:

Current experimentation will continue with techniques for enhancement of ERTS-1 MSS and subsidiary remote sensing data. For regions in which suitable data having seasonal variation is available, we will investigate false color multi-seasonal composites using our additive color viewer. Preliminary work with this technique is planned in the southern Sierra Nevada. Additional research will be conducted on photographic edge enhancement and directional pattern filtering, for possible comparison with commercially available video-display enhancement techniques.

### C. Data Source Research:

We will continue to accumulate and index pertinent reference material on key areas within the Test Site. Map compilations are in preparation for the distribution of recorded earthquake epicenters, and known geothermal sources within the site.

IX. Authorized Reports and Publications:

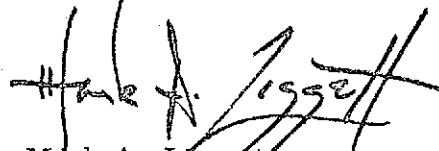
No publications or formal presentations of research findings have been made during this reporting interval.

X. Changes in NDPF Standing Order Form:

No changes have been made in our Standing Order Form of 18 October 1972. Routine ERTS-1 MSS coverage was terminated as of July 1973 as originally proposed.

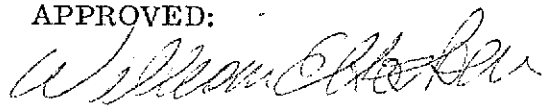
XI. NASA Data Requests:

Retrospective request for ERTS-1 MSS Frame #1069-17434 9.5 positive transparencies for Bands 4-7: 10 August 1973.



Mark A. Liggett,  
Co-investigator

APPROVED:



William E. Hosken,  
President